06/60/90 JC408 U.S. PTO

Jc551 U.S. PTO 09/328893 06/09/99

LAW OFFICES
SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC
2100 PENNSYLVANIA AVENUE, N.W.
WASHINGTON, DC 20037-3213
TELEPHONE (202) 293-7060
FACSIMILE (202) 293-7860

June 9, 1999

BOX PATENT APPLICATION
Assistant Commissioner for Patents
Washington, D.C. 20231

Re: Application of **Jorg SCHABERNACK and Monika BANZHAF**
MANAGEMENT OF A NETWORK ELEMENT USING MANAGED OBJECTS IN A DIGITAL COMMUNICATIONS NETWORK
Our Ref. Q54532

Dear Sir:

Attached hereto is the application identified above including 12 sheets of the specification, claims, 2 sheets of formal drawings, executed Assignment and PTO 1595 form, and executed Declaration and Power of Attorney. Also enclosed is the Information Disclosure Statement.

The Government filing fee is calculated as follows:

Total claims	10	-	20	=	0	x	$18.00	= $.00
Independent claims	2	-	3	=	0	x	$78.00	= $.00
Base Fee								$760.00
TOTAL FILING FEE								**$760.00**
Recordation of Assignment								$40.00
TOTAL FEE								**$800.00**

Checks for the statutory filing fee of $760.00 and Assignment recordation fee of $40.00 are attached. You are also directed and authorized to charge or credit any difference or overpayment to Deposit Account No. 19-4880. The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 and 1.17 and any petitions for extension of time under 37 C.F.R. § 1.136 which may be required during the entire pendency of the application to Deposit Account No. 19-4880. A duplicate copy of this transmittal letter is attached.

Priority is claimed from June 12, 1998 based on German Application No. 19826088.1. The priority document is enclosed herewith.

Respectfully submitted,
SUGHRUE, MION, ZINN,
MACPEAK & SEAS, PLLC
Attorneys for Applicant

By: _____
David J. Cushing
Registration No. 28,703

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Jorg SCHABERNACK, et al.	Attorney Docket Q54532
Appln. No.: Not yet asssigned	Group Art Unit: Not yet assigned
Filed: June 9, 1999	Examiner: Not yet assigned

For: MANAGEMENT OF A NETWORK ELEMENT USING MANAGED OBJECTS IN A DIGITAL COMMUNICATIONS NETWORK

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination, please amend the above-identified application as follows:

IN THE SPECIFICATION:

Page 1, after the title, insert the heading: --**Background of the Invention**--.

Page 2, between lines 6 and 7 (not counting paragraph spaces), insert the heading:

--**Summary of the Invention**--.

Page 3, between lines 26 and 27 (not counting paragraph spaces), insert the heading:

--**Brief Description of the Drawings**--.

Page 4, between lines 5 and 6 (not counting paragraph spaces), insert the heading:

--**Detailed Description of the Invention**--.

IN THE ABSTRACT:

After then heading, delete the title in its entirety.

After the abstract, delete "(Fig. 1).

REMARKS

Entry and consideration of this Amendment is respectfully requested.

Respectfully submitted,

David J. Cushing
Registration No. 28,703

SUGHRUE, MION, ZINN,
MACPEAK & SEAS, PLLC
2100 Pennsylvania Avenue, N.W.
Washington, D.C. 20037-3213
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

Date: June 9, 1999

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Management of a Network Element Using Managed Objects in a Digital Communications Network

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In digital communications networks, particularly in SDH networks (SDH = Synchronous Digital Hierarchy), a database containing data about the current network configuration is provided for each network element. The network element is managed by a controller using managed objects.

In an article by M. P. Bosse et al entitled "Management von SDH-Netzelementen: eine Anwendung der Informationsmodellierung", which appeared in "Elektrisches Nachrichtenwesen", 4th Quarter 1993, a journal published by the applicant, a method and hardware for managing network elements in digital communications networks are described on pages 329 to 338. With reference to Fig. 2 of the article it is described that SDH network elements are managed with the so-called OSI system management (OSI = Open Systems Interconnection). Management is provided by accessing managed objects, which contain all relevant data. On page 332 of the article, the properties of the managed objects as well as elements used for OSI communication, particularly the common management information system

element (CMISE), are described. The CMISE supports several services for accessing the managed objects. As shown in Fig. 2 of the article, the network element includes a controller and a database MIB (management information base) connected thereto, whose function is not described, however.

It is an object of the invention to provide a method and apparatus for managing a network element using managed objects. The apparatus is to be simple in construction and to enable fast access to the managed objects needed.

This object is attained by a method with the features according to claim 1 and by a network element and a digital communications network with the features according to the respective independent claims.

Accordingly, in response to a request for access to one of the managed objects, a check is made to determine whether this requested object is stored in the memory. If this requested object is not stored in the memory, a check is made to determine whether there is sufficient memory space to write this object into the memory. If there is no sufficient memory space, at least one of the stored objects is swapped out of the memory to a database in accordance with at least one predeterminable criterion. The requested object is then read from the database and written into the memory.

Thus, individual objects are removed from the memory according to predeterminable criteria in order to make room for new requested objects. The old objects are moved to the database, from where they can be written back into the memory if required. As a result, even

large network elements which must have access to a large number of managed objects require only simple, small-capacity memories while all managed objects are still available.

Further advantageous features are defined in the subclaims.

It is particularly advantageous if, based on the criterion, objects which are frequently accessed remain in the memory. In this manner, swap-out and restoring of objects is required as seldom as possible. Particularly frequently needed objects will thus remain in the memory, which can be accessed very fast. Particularly rarely needed objects will remain in the memory only for the duration of the access.

It is also advantageous if only a predeterminable number of recently accessed objects remain in the memory. Thus, the recently very frequently used objects, i.e., the objects which are very likely to be accessed again, remain in the memory.

The predeterminable criterion is advantageously implemented as a filter function, particularly as a CMISE filter function. The filter function indicates which objects are to remain in the memory. Thus, preferably those objects which have particular properties, such as specific names, attributes, or the like, remain in the memory.

The invention will become more apparent from the following description of an embodiment when taken in conjunction with the accompanying drawings, in which:

COPY

Fig. 1 is a schematic block diagram showing the interconnection of a controller, a database, and a memory for a network element; and

Fig. 2 is a flowchart showing the steps of the method according to the invention.

Fig. 1 shows schematically the interconnection of the following components of a network element for a digital communications network: a controller FLT, a database DB connected thereto, and a memory MEM connected thereto. Both the database DB and the memory MEM serve to store managed objects. The interconnection forms part of a network element (not shown) for an SDH network. Access to the managed objects is obtained via CMISE requests.

The memory MEM, which is a fast access semiconductor memory, contains objects MO1 and MO2, for example. The database DB, which is implemented on a hard disk, contains objects swapped out of the memory, for example the object MO*. The controller FLT processes requests RQ for access to the objects.

When a request appears at the input of the controller FLT, the latter will control read and write accesses to the semiconductor memory or the hard disk where the corresponding objects are stored. On application of a request for access to a stored object, such as the object MO2, the controller FLT will control the reading of this object MO2 from memory MEM. On application of a request for access to an object not contained in memory MEM, for example the request RQ* for access to the

object MO*, the controller FLT will control the reading of this object MO* from the database DB into the memory.

The controller FLT thus performs a filter function which selects the incoming requests RQ according to whether access to objects in the memory or access to objects no longer or not yet stored in the memory is desired. An additional filter function, particularly the function of a CMISE filter, can be implemented which selects objects based on their properties. Based on attributes, for example, decisions are made as to which objects are to remain in the memory.

The controller FLT further controls the swapping of objects out of the memory MEM to the database DB in order to make room for new objects. Thus, at least the swapped-out objects are stored in the database and remain there for subsequent requests for accesses. It is also possible to use a larger database in which all managed objects are permanently stored. The database DB thus performs a backup function for the memory MEM. If the contents of the memory MEM should be destroyed due to a malfunction, all objects are still available from the database DB.

The operation of the controller FLT will now be described in more detail with reference to Fig. 2, which is a flowchart showing the steps of a method 100 for managing the network element. The method 100 comprises the following steps 110 to 150:

In a first step 110, in response to a request for access to the managed object MO*, a check is made to determine whether this requested object is stored in

the memory. If that is not the case, a check is made in a second step 120 to determine whether there is sufficient memory space in the memory.

If that is not the case, in a step 130, stored objects are swapped out of the memory in accordance with predeterminable criteria to make room for the requested object. In this example, the criterion is the frequency of previous accesses to the objects. The most frequently used objects will remain in the memory and will not be swapped out to the database. In this example, a check is made to determine how frequently each of the objects was accessed within a period of half an hour. The frequency is compared with a predetermined minimum. If there is too little memory space, the objects which were accessed with a frequency below the predetermined minimum, i.e., the recently least used objects, will be swapped out of the memory to the database. There is little probability of these objects being used again.

It is also possible to leave only a predeterminable number of those objects in the memory which were recently accessed very often, for example the last ten recently most used objects.

To make room for the requested object MO*, in step 130, the object MO1 shown in Fig. 1, for example, is removed from the memory and written into the database DB, where it can be retrieved for subsequent requests. Thus, less frequently needed objects are swapped out to the database.

In a next step 140, the requested object MO* is transferred from the database DB back into the fast access memory MEM.

In a last step 150, the network element is managed in response to requests (CMISE requests) by accessing the memory and using the objects stored therein.

The above-described method can be summarized as follows:

If the requested object MO* is not yet or no longer stored in the memory (step 110), it will be retrieved from the database and, if there is sufficient memory space (step 120), written (back) into the memory (step 140). Otherwise it can be used immediately. If there is no sufficient memory space (step 120), room has to be made by swapping out "old" objects (step 130). Each request is processed by an access to the memory (step 150).

It is also possible to make room for "new" objects in the memory independently of the current usage of the memory, for example at predetermined time intervals. In this manner, the memory is "cleared up" from time to time and sufficient memory space is provided as a precaution.

The invention is particularly suited for use in SDH network elements, particularly in crossconnects.

Patent Claims

1. A method (100) of managing a network element using managed objects (MO1, MO2, MO*) wherein the network element is managed in response to requests (RQ) by accessing a memory (MEM) and using the objects (MO1, MO2, MO*) stored therein, said method (100) comprising the steps of:

   checking in response to a request (RQ = RQ*) for access to one (MO*) of the managed objects (MO1, MO2, MO*) whether this requested object (MO*) is stored in the memory (MEM) (step 110);

   if this requested object (MO*) is not stored in the memory (MEM), checking whether there is sufficient memory space to write this object (MO*) into the memory (MEM) (step 120);

   if there is no sufficient memory space, swapping at least one (MO1) of the stored objects (MO1, MO2) out of the memory (MEM) to a database (DB) according to at least one predeterminable criterion (step 130); and

reading the requested object (MO*) from the database(DB) and writing it into the memory (MEM) (step 140).

2. A method (100) as claimed in claim 1 wherein based on the criterion, the objects (MO2) which are accessed most frequently remain in the memory (MEM).

3. A method as claimed in claim 2 wherein only a predeterminable number of recently accessed objects remain in the memory.

4. A method as claimed in claim 1 wherein the predeterminable criterion is a filter function, particularly a CMISE filter function, which indicates which objects are to remain stored in the memory.

5. A method as claimed in claim 1 wherein the predeterminable criterion is a length of time which indicates how long each of the objects may remain stored in the memory.

6. A method as claimed in claim 1 wherein the predeterminable criterion is a maximum number which indicates how many objects may remain stored in the memory.

7. A network element for a digital communications network comprising a controller (FLT) for managing the network element using managed objects (MO1, MO2, MO*), a memory (MEM) connected to the controller (FLT), and a database (DB) connected to the controller (FLT), wherein the controller (FLT), in response to requests (RQ), manages the network element by accessing the memory (MEM) and using the objects (MO1, MO2, MO*)

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stored therein, wherein in response to a request (RQ = RQ*) for access to one (MO*) of the managed objects (MO1, MO2, MO*), the controller (FLT) checks whether this requested object (MO*) is stored in the memory, wherein, if this requested object (MO*) is not stored in the memory (MEM), the controller (FLT) checks whether there is sufficient memory space to write this object (MO*) into the memory (MEM), wherein, if there is no sufficient memory space, the controller (FLT) causes at least one (MO1) of the stored objects (MO1, MO2) to be swapped out of the memory (MEM) to a database (DB) according to at least one predeterminable criterion, and wherein the controller (FLT) reads the requested object (MO*) from the database (DB) and writes it into the memory (MEM).

8. A network element as claimed in claim 7 wherein the memory is a semiconductor memory (MEM), and wherein the database (DB) is implemented on a nonvolatile mass storage, particularly on a hard disk.

9. A digital communications network with network elements each comprising a controller (FLT) for managing the network element using managed objects (MO1, MO2, MO*), a memory (MEM) connected to the controller (FLT), and a database (DB) connected to the controller (FLT), wherein the controller (FLT), in response to requests (RQ), manages the network element by accessing the memory (MEM) and using the objects (MO1, MO2, MO*) stored therein, wherein in response to a request (RQ = RQ*) for access to one (MO*) of the managed objects (MO1, MO2, MO*), the controller (FLT) checks whether this requested object (MO*) is stored in the memory, wherein, if this requested object (MO*) is not stored in the memory (MEM), the controller (FLT) checks

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whether there is sufficient memory space to write this object (MO*) into the memory (MEM), wherein, if there is no sufficient memory space, the controller (FLT) causes at least one (MO1) of the stored objects (MO1, MO2) to be swapped out of the memory (MEM) to a database (DB) according to at least one predeterminable criterion, and wherein the controller (FLT) reads the requested object (MO*) from the database (DB) and writes it into the memory (MEM).

10. A communications network as claimed in claim 9, particularly an SDH network, wherein the network elements are crossconnects, add-drop multiplexers, and/or line multiplexers.

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Abstract of the Disclosure

Management of a Network Element Using Managed Objects in a Digital Communications Network

Network elements of a digital communications network, for example of an SDH network (SDH = Synchronous Digital Hierarchy), are managed by controllers using managed objects. To permit fast access to managed objects, a simple circuit with a controller (FLT), a database (DB), and a temporary memory (MEM) is proposed. The controller carries out a method of managing the network element wherein in response to requests (RQ), the objects are stored into the memory and individual objects (MO*) are swapped out to make room for new data according to predeterminal criteria, which specify, for example, the maximum residence time of the object in the memory. At least these objects are transferred to the database (DB). Only upon reception of a request (RQ*) for access to an object (MO*) which is no longer in the memory (MEM) will this object (MO*) be read from the database and transferred back into the memory. The controller manages the network element in response to the requests by accessing the memory and using the objects stored therein.

(Fig. 1)

ZPL/S-JS/Ke/Lo
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4350" EE6226D

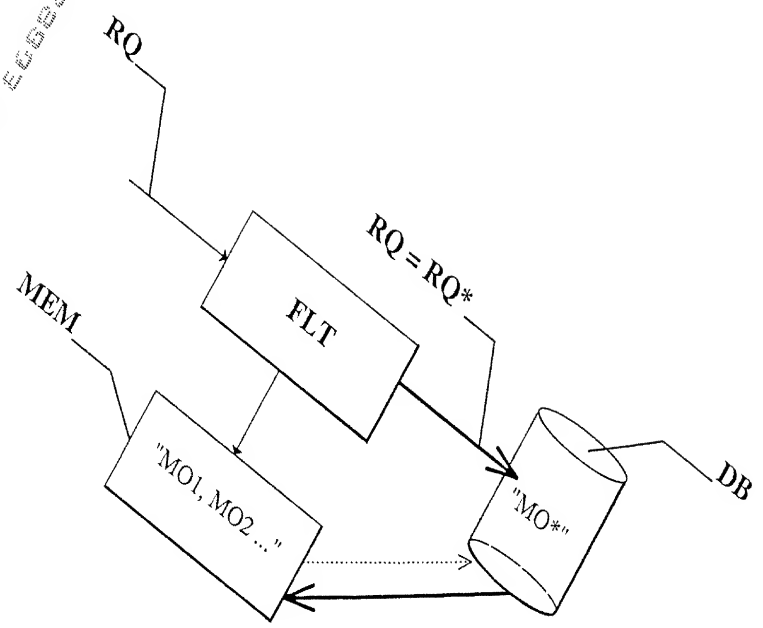

Fig.1

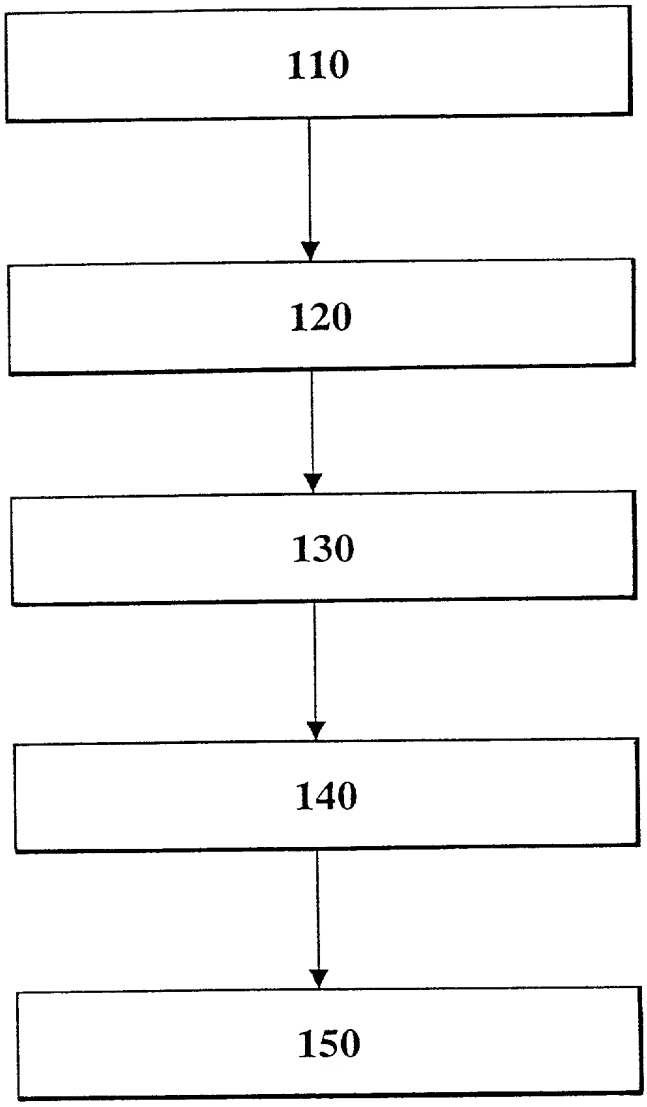

Fig. 2

100

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; that I verily believe I am an original, first and joint inventor, together with the other inventors listed below, of the subject matter claimed and for which a patent is sought in the application entitled:

Management of a Network Element Using Managed Objects in a Digital Communications Network

which application is:

☐ the attached application (for original application)

☐ Application Serial No: filed , and amended on

(for declaration not accompanying application)

that I have reviewed and understand the contents of the specification of the above-identified application, including the claims, as amended by any amendment referred to above; that I acknowledge my duty to disclose information of which I am aware which is material to the patentability of this application under 37 C.F.R. 1.56, that I hereby claim priority benefits under Title 35, United States Code §119, §172 or §365 of any provisional application or foreign application(s) for patent or inventor's certificate listed below and have also identified on said list any foreign application for patent or inventor's certificate on this invention having a filing date before that of any foreign application on which priority is claimed:

Application Number	Country	Filing Date	Priority Claimed
198 26 088.1	Germany	June 12, 1998	Yes

I hereby claim the benefit of Title 35, United States Code §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in a listed prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge my duty to disclose any information material to the patentability of this application under 37 C.F.R. 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Application Serial No.	Filing Date	Status

I hereby appoint John H. Mion, Reg. No. 18,879; Thomas J. Macpeak, Reg. No. 19,292; Robert J. Seas, Jr., Reg. No. 21,092; Darryl Mexic, Reg. No. 23,063; Robert V. Sloan, Reg. No. 22,775; Peter D. Olexy, Reg. No. 24,513; J. Frank Osha, Reg. No. 24,625; Waddell A. Biggart, Reg. No. 24,861; Louis Gubinsky, Reg. No. 24,835; Neil B. Siegel, Reg. No. 25,200; David J. Cushing, Reg. No. 28,703, John R. Inge, Reg. No. 26,916; Joseph J. Ruch, Jr., Reg. No. 26,577; Sheldon I. Landsman, Reg. No. 25,430; Richard C. Turner, Reg No. 29,710; Howard L. Bernstein, Reg. No. 25,665; Alan J. Kasper, Reg. No. 25,426; Kenneth J. Burchfiel, Reg. No. 31,333; Gordon Kit, Reg. No. 30,764; Susan J. Mack, Reg. No. 30,951; Frank L. Bernstein, Reg. No. 31,484; Mark Boland, Reg. No. 32,197; William H Mandir, Reg. No. 32,156; Scott M. Daniels, Reg. No. 32,562; Brian W. Hannon, Reg. No. 32,778; Abraham J. Rosner, Reg. No. 33,276, Bruce E. Kramer, Reg. No. 33,725; Paul F. Neils, Reg. No. 33,102; Brett S. Sylvester, Reg. No. 32,765; and Robert M. Masters, Reg. No 35,603, my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and request that all correspondence about the application be addressed to **SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC**, 2100 Pennsylvania Avenue, N.W., Washington, D.C. 20037-3213.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date May 19, 1999 First Inventor Jörg (First Name) Middle Initial SCHABERNACK (Last Name)

Residence Vaihingen (City) Germany (State/Country) Signature Jörg Schabernack

Post Office Address: Jägerstrasse 31
71665 Vaihingen, Germany

Citizenship German

Date May 19, 1999 Second Inventor Monika (First Name) M. (Middle Initial) BANZHAF (Last Name)

Residence Stuttgart (City) Germany (State/Country) Signature M. Banzhaf

Post Office Address: Im Pfädlen 1
70439 Stuttgart, Germany

Citizenship German

Date _____ Third Inventor _____ (First Name) _____ (Middle Initial) _____ (Last Name)

Residence _____ (City) _____ (State/Country) Signature _____

Post Office Address: _____

Citizenship _____

Date _____ Fourth Inventor _____ (First Name) _____ (Middle Initial) _____ (Last Name)

Residence _____ (City) _____ (State/Country) Signature _____

Post Office Address: _____

Citizenship _____